

**A new species of *Austropsocus*
(Psocodea: 'Psocoptera': Pseudocaeciliidae)
with a peculiar forewing venation from New Caledonia**

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A new species of *Austropsocus* (Psocodea: 'Psocoptera': Pseudocaeciliidae) with a peculiar forewing venation from New Caledonia. - *Austropsocus millei* sp. n. is described and illustrated on the basis of a single male from New Caledonia. Based on general morphology the new species is assigned to the genus *Austropsocus*, in spite of its very peculiar, autapomorphic forewing venation. Contrary to the relatively simple *Caecilius*-type venation present in all previously known pseudocaeciliids, this species has multi-branched Rs and M veins (5-6 branches each) in the apical third of the forewing, and a multitude of transversal veinlets or short spur-veins in its basal two thirds, forming a reticulate pattern in the area between the veins R/R1 and M+Cu/CuA. This forewing venation shows striking similarities to that known from certain representatives of the closely related family Calopsocidae. This situation is interpreted as a case of parallel evolution.

Keywords: Zelandopsocinae - Calopsocidae - wing morphology - parallelism.

INTRODUCTION

The discovery of an unusual new species with striking autapomorphic structures may often lead to the erection of a new monotypic genus, which involves the risk that an existing and closely related genus becomes paraphyletic. An example in the Psocoptera is the troglomorphic genus *Troglotroctes* Lienhard (Liposcelididae) which is probably phylogenetically embedded within the large genus *Liposcelis* Motschulsky (see Grimaldi & Engel, 2006; Yoshizawa & Lienhard, 2010). If no sufficient phylogenetic data on the group concerned are available, it is often preferable to assign the unusual new species to a closely related existing genus, even if this may create problems for identification keys in the case that key characters are strongly modified in the new species. Examples are the three extraordinary species of *Odontopsocus* Badonnel (Epipsocidae), *Lachesilla* Westwood (Lachesillidae) and *Ectopsocus* McLachlan (Ectopsocidae) described by Lienhard (2002), or the sexually dimorphic pseudocaeciliid *Ophiodopelma glyptocephalum* Lienhard (Lienhard, 1985).

In here I describe an extraordinary New Caledonian pseudocaeciliid belonging to the subfamily Zelandopsocinae. This subfamily consists of 4 genera: *Zelandopsocus* Tillyard (31 species), *Austropsocus* Smithers (31 species), *Novopsocus* Thornton (3 species) and *Howeanum* Smithers (2 species) (see Lienhard & Smithers, 2002;

Schmidt & Smithers, 2004; Cuénoud, 2008). Besides the New Guinean endemic *Novopsocus*, most zelandopsocines are exclusively known from Australia, New Zealand and New Caledonia (see Lienhard & Smithers, 2002). 74% of the Psocoptera species known from New Caledonia (including Loyalty Islands) belong to this subfamily (see Lienhard, 2004), i. e. 27 species of *Zelandopsocus* and 7 species of *Austropsocus*, all of them described by Thornton & Smithers (1974). Both genera were at that time assigned to the family Philotarsidae, essentially because they have 3-segmented tarsi. Their transfer to the family Pseudocaeciliidae, which generally has 2-segmented tarsi, was proposed by Mockford (1984).

Among the numerous specimens of Zelandopsocinae collected by Christian Mille in New Caledonia and deposited in the Psocoptera collection of the Geneva Natural History Museum, there is one male showing an unusual forewing venation, which is completely different from the venation of the *Caecilius*-type (*sensu* Badonnel, 1951) present in all previously known pseudocaeciliids. At first glance this extraordinary specimen was supposed to represent a new genus. However, in view of the difficulties in defining certain zelandopsocine genera as monophyletic groups (see Thornton & Smithers, 1974; Thornton, 1984; Cuénoud, 2008), this very particular male is described here as a new species of the possibly paraphyletic genus *Austropsocus*.

MATERIAL AND METHODS

Dissection and slide-mounting followed the methods described by Lienhard (1998). The material examined (holotype) is deposited in the Psocoptera collection of the Muséum d'histoire naturelle, Geneva, Switzerland (MHNG).

Abbreviations of wing veins are used according to Yoshizawa (2005). The following other abbreviations are used in the description: BL = body length (in alcohol); F = hindfemur (length); FW = forewing (length); HW = hindwing (length); IO/D = shortest distance between compound eyes divided by anteroposterior diameter of compound eye in dorsal view of head; T = hindtibia (length); t1, t2, t3 = tarsomeres of hindtarsus (length, measured from condyle to condyle).

DESCRIPTION

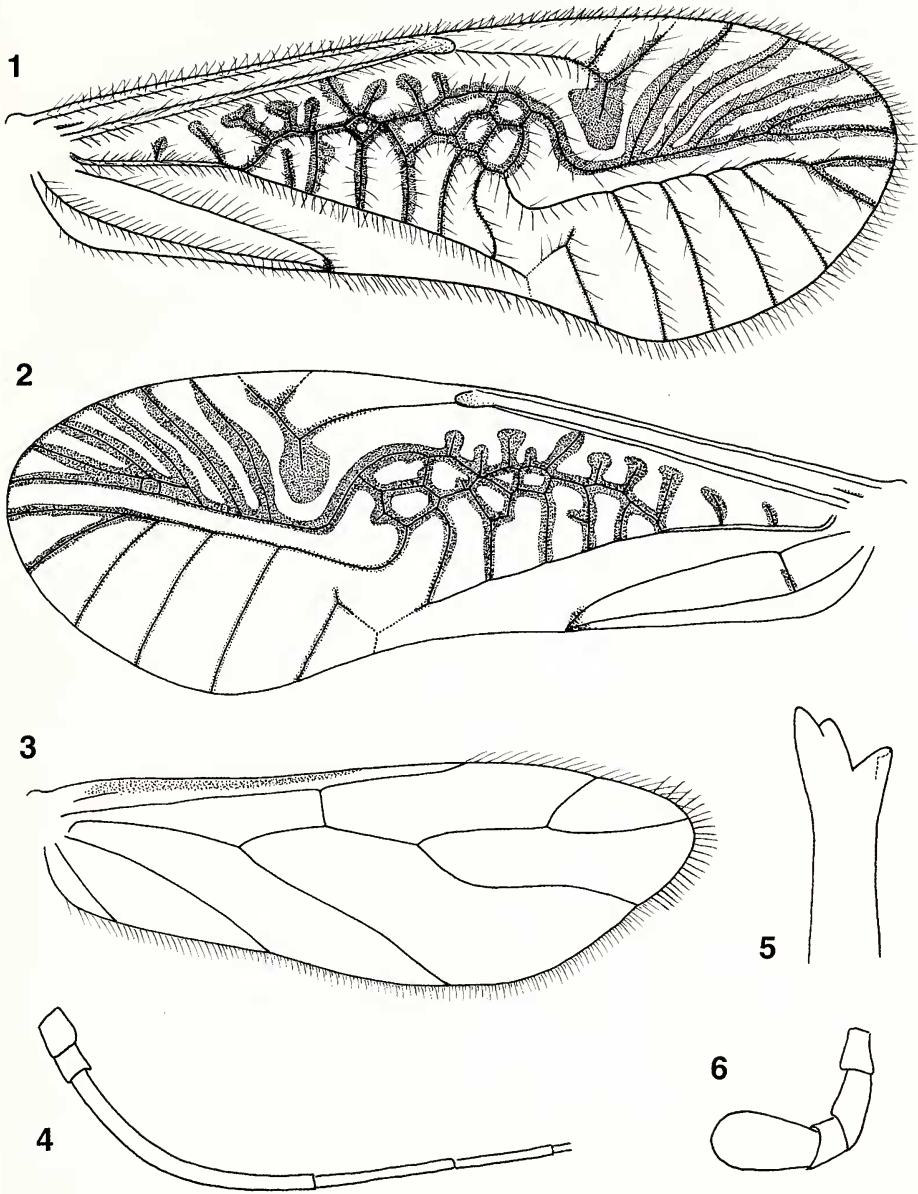
Austropsocus millei sp. n.

Figs 1-9

HOLOTYPE: MHNG (2 slides, remaining parts in alcohol); male; New Caledonia, Boulouparis, Réserve du Mont Do, 795m, Malaise trap; 7.xii.2006-4.i.2007; leg. C. Mille.

DESCRIPTION OF MALE (female unknown): *Colouration*. Body light grey-brown to medium brown. Head without striking colour pattern, compound eyes black. Antenna light to medium brown, maxillary palp dark brown. Legs light brown, tarsi and basal area of coxae darker brown. Forewing with dark brown pigmentation along most of the veins forming a striking pattern (Figs 1, 2), hindwing hyaline except for a slightly brown zone in basal half along anterior margin (Fig. 3).

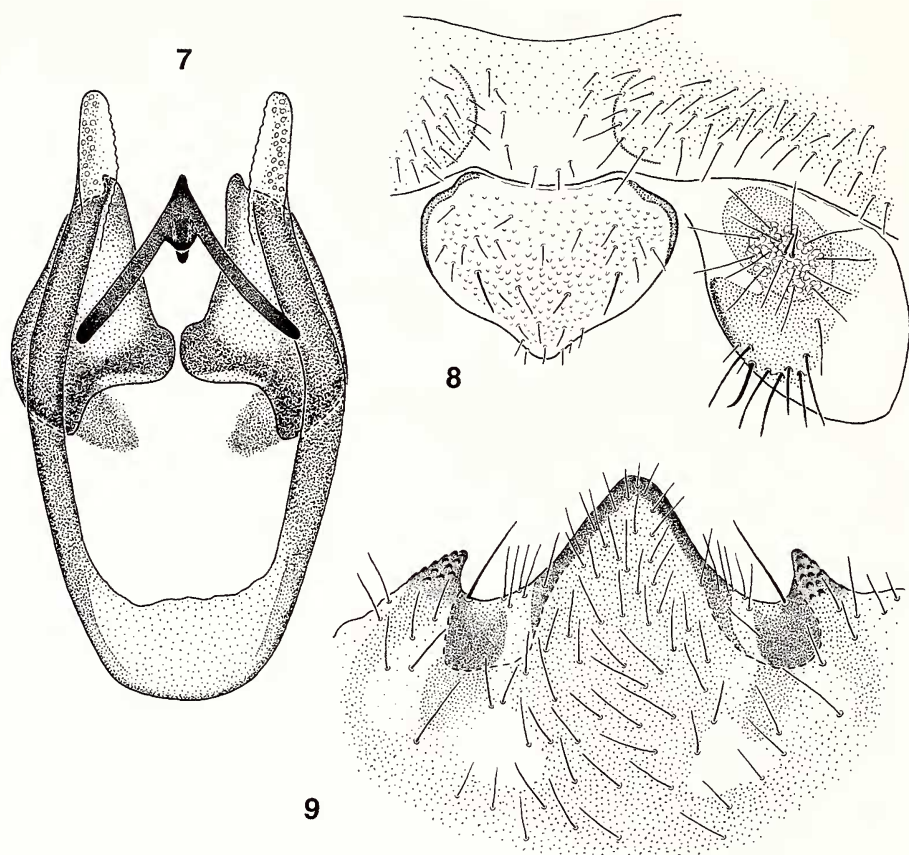
Morphology. Head shape normal, vertex regularly rounded, without median emargination, ocelli well-developed, compound eyes relatively small (IO/D 2.4). Antenna 13-segmented, flagellum bearing long hairs and some shorter setae; long hairs



FIGS 1-6

Austropsocus millei sp. n., male holotype. (1) Right forewing. (2) Left forewing (pilosity not shown). (3) Right hindwing. (4) Basalmost five articles of antenna (pilosity not shown). (5) Lacinial tip. (6) Maxillary palp (pilosity not shown).

particularly dense on first flagellar segment, this flagellomere slightly curved and somewhat thicker than second flagellomere (Fig. 4). Maxillary palp with terminal segment relatively short and thick, not longer than twice its width (Fig. 6). Lacinial tip



FIGS 7-9

Austropsocus millei sp. n., male holotype. (7) Phallosome. (8) Clunium, epiproct and right paraproct. (9) Hypandrium.

with a short inner tine and a longer, broader and apically bifid outer tine (Fig. 5). Marginal labral sensilla of type 2 (Mockford, 1984: fig. 2). Legs with 3-segmented tarsi, pretarsal claws lacking preapical tooth, with broad, membranous pulvillus. Pearman's organ on hindcoxa well-developed.

Wings of normal shape (i. e. greatest breadth at about 2/3 of their length), flat and membranous (not coriaceous and folded or vaulted), lacking distinct bulges or lobes. Forewing with a very distinctive venation (Figs 1, 2): Rs and M each with 5-6 branches, R1 bifurcate distally in pterostigma, the latter posteriorly with a long spur-vein; areola postica angled, with a short spur-vein at its apex, directed towards M; left forewing with a crossvein between CuP and A1 and two short crossveins between posterior branches of R; both forewings with an irregular and slightly variable reticulation in the area between veins R/R1 and M+Cu/CuA, this reticulation formed by Rs and M (not recognizable as principal veins) and a series of accessory transversal

veinlets and spur-veins. Margin and all veins of forewing setose, mostly with more than one row of setae. Only one row of setae in CuP, CuA1, M branches, most of Rs branches, most accessory veins and posterior margin between wing base and nodulus. Hindwing (Fig. 3) with normal venation (left hindwing with a short vertical spur-vein at about 1/3 of CuA directed towards Rs+M), veins bare, margin setose between R1 and M, with microtrichia from M to posterior wing base.

Terminalia as in Figs 7-9. Clunium simple, laterally completely fused with hypandrium; epiproct simple; paraproct sensorium with 14 trichobothria in basal rosettes surrounding two shorter setae without rosettes, posterior margin of paraproct with a small hair and a particularly stout seta close to each other. Hypandrium trilobate, median lobe tapering to narrowly rounded tip, lateral lobes much shorter, more pointed and slightly rugose; a pair of broadly rounded sclerotized areas present on dorsal side of hypandrium, between lateral and median lobes (see interrupted lines in Fig. 9). Phallosome with a pair of subtriangular plate-like lateral sclerites and an apically pointed aedeagal sclerite; the latter medially bearing a subapical thickening extended into a short anteriorly-directed rod; endophallus with a suboval, irregularly delimited sclerotized area on each side but lacking denticulate structures. Eversible vesicles on ventral side of abdomen not observed.

Measurements. BL = 1.7 mm; FW = 2.9 mm; HW = 2.2 mm; F = 635 μ m; T = 1058 μ m; t1 = 293 μ m; t2 = 53 μ m; t3 = 75 μ m.

ETYMOLOGY: The species is dedicated to its collector, Dr Christian Mille (IAC, Institut Agronomique néo-Calédonien, La Foa, New Caledonia).

DISCUSSION

Using general keys to Psocoptera families (Smithers, 1990; Lienhard, 1998; New & Lienhard, 2007), the male described above is identified as belonging to the family Pseudocaeciliidae. In the keys to genera published by Thornton (1981) and New & Lienhard (2007) it keys out as a member of the genus *Austropsocus*, and in the key to New Caledonian species by Thornton & Smithers (1974) it is assigned to a small group of *Austropsocus* species, comprising *A. productus* Thornton & Smithers and *A. thapsinus* Thornton & Smithers. These species are characterized by bare hindwing veins, 3-lobed hypandrium and phallosome with a pair of subtriangular plate-like sclerites. Comparing the morphology of the terminalia of the present specimen with the figures published by Thornton & Smithers (1974), it seems to be more closely related to *A. productus* than to *A. thapsinus*. However, it clearly differs from *A. productus* by the very particular forewing venation, the setose CuP in the forewing, the absence of a sclerotized peg on the posterior margin of the clunium, some details of the hypandrium and the phallosome, and by the colouration. Probably it also differs from *A. productus* and the other New Caledonian species of *Austropsocus* by the relatively short and thick terminal article of the maxillary palp and by the curved and slightly thickened first antennal flagellomere. Both characters are not explicitly mentioned by Thornton & Smithers (1974). In general, Pseudocaeciliidae have a slender and straight first flagellomere (width and shape similar to that of the second flagellomere) and a slender terminal article of the maxillary palp (about 3 times longer than wide).

The similarity to other New Caledonian representatives of the genus *Austropsocus* and the problems about generic definitions within the Zelandopsocinae (see Introduction) led me to place this surprising specimen in the genus *Austropsocus* rather than establishing a new genus merely based on the autapomorphic forewing venation. A somewhat similar case of a spectacular autapomorphy in a single species of Pseudocaeciliidae, clearly assignable to a known genus, is the pseudocaeciliine *Ophiodopelma glyptocephalum* Lienhard, where head morphology is strongly modified (Lienhard, 1985). Nothing similar to the specialized head structures of *O. glyptocephalum* is known in Psocoptera, contrary to the case of *A. millei*. The forewing venation of the latter shows striking similarities to that known from certain representatives of the family Calopsocidae, i. e. multi-branched R and M veins and an extensive reticulate network of secondary veinlets (see Thornton & Smithers, 1984). However, calopsocids have 2-segmented tarsi and setose hindwing veins and are characterized by the following synapomorphies: setose wing membranes in forewing and hindwing, and sharp-edged vertex with a strong median emargination. According to Yoshizawa (2002) the family Pseudocaeciliidae has to be regarded as a paraphyletic group, and the family Calopsocidae as a highly specialized clade within it. The presence of a calopsocid-like forewing venation in *Austropsocus millei*, in combination with some plesiomorphic characters states (3-segmented tarsi, normal head shape and bare wing membranes), suggests that the similarity between *A. millei* and the Calopsocidae is based on synapomorphy, and that this species should be regarded as a basal member of the Calopsocidae clade. However, the particular combination of accessory veins and striking colour pattern in the forewing of *A. millei* (Figs 1, 2), never seen in Calopsocidae which have uniformly brown wings (see figures in Thornton & Smithers, 1984), rather supports the interpretation that this wing structure is homoplasious to similar structures in the Calopsocidae. More general molecular phylogenetic analyses of Psocodea by Johnson *et al.* (2004) and Yoshizawa & Johnson (2010) also included a species of *Calopsocus* Hagen and representatives of several genera of Pseudocaeciliinae. Both papers suggested that the Calopsocidae are embedded in the latter. Johnson *et al.* (2004) also analysed a species of *Austropsocus* and *Zelandopsocus* and clearly showed that Zelandopsocinae are rather distantly related to the Pseudocaeciliinae + Calopsocidae clade. These data support my assumption that the apomorphic forewing modifications evolved independently in *A. millei* and in the Calopsocidae. Therefore the hypothesis that *A. millei* has to be regarded as a basal member of the Calopsocidae clade is here rejected. Nothing is known about the biology of Calopsocidae (New & Lienhard, 2007) and of the new species. Thus no adaptation to similar conditions by parallel evolution can be postulated.

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